AN3029
Application note

Getting started with STM8L and STM8AL

Introduction

This application note complements the information in the STM8L and STM8AL datasheets by describing the minimum hardware and software environment required to build an application around an STM8L or STM8AL 8-bit microcontroller device.

A brief description of the principal hardware components is given. The power supply, analog-to-digital converter (ADC), clock management, and reset control are described in some detail. In addition, some hardware recommendations are given. This application note also contains detailed reference design schematics with descriptions of the main components. The STM8 development tools and software toolchain are common to STM8L, STM8S, STM8AL, and STM8AF and are presented in *Section 8*, and *Section 9*. *Section 10* describes how to set up the STM8 development environment. Finally, *Section 11* provides a list of relevant documentation and online support resources.

Table 1. Applicable products

Product family	Part numbers
Microcontrollers	– STM8L051/52 – STM8L101 – STM8L151C2/K2/G2/F2 and STM8L151C3/K3/G3/F3 – STM8L151x4, STM8L151x6, STM8L152x4, STM8L152x6 – STM8L151x8, STM8L152x8, STM8L151R6, STM8L152R6, STM8L162R8, STM8L162M8 – STM8AL313x, STM8AL314x, STM8AL316x, STM8AL3L4x, STM8AL3L6x

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1 Hardware requirements summary

To build an application around an STM8L or STM8AL device, the application board should provide the following features:

- Power supply (mandatory)
- Clock management (optional)
- Reset management (optional)
- Debugging tool support: Single wire interface module (SWIM) connector (optional)

2 Power supply

2.1 Power supply overview

The STM8L or STM8AL can be supplied through a 1.65 V to 3.6 V external source (1.8 V to 3.6 V for STM8L05xxx). For medium density STM8L15xxx, medium density STM8AL31xx/STM8AL3Lxx, and high density STM8L15xxx/STM8L162xx with BOR, the power supply must be above 1.8 V at power-on and can go down to 1.65 V at power-down.

An on-chip power management system provides the constant digital supply to the core logic, both in normal and low power modes. This guarantees that the logic consumes a constant current over the voltage range. It is also capable of detecting voltage drops and generate reset to avoid heratic behavior.

The STM8L and STM8AL devices provide:

- Depending on packages, one pair of pads (V_{DD}/V_{SS}), or several pairs of pads (V_{DDx}/V_{SSx}) from 1.65 V or 1.8 V to 3.6 V.
  All V_{DDx} and V_{SSx} must be at the same potential respectively. The V_{DDx} pins must be connected to V_{DD} with external decoupling capacitors: one 100 nF Ceramic capacitor for each V_{DDx} pin and one single 1 µF Tantalum or Ceramic capacitor.

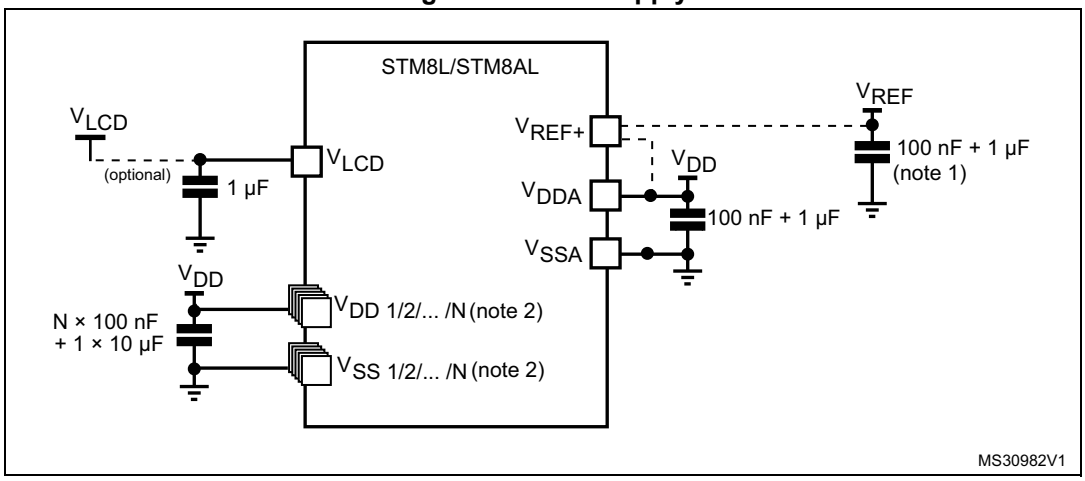
The STM8L15xxx, STM8AL31xx, and STM8L162xx devices also provide in some packages:

- One pair of pads, V_{DDA}/V_{SSA}, dedicated to analog functions. V_{DDA} and V_{SSA} must be at the same potential respectively as V_{DD} and V_{SS}. Refer to *Section 3: Analog-to-digital converter (ADC)* for more details. The V_{DDA} pin must be connected to two external decoupling capacitors (one 100 nF Ceramic capacitor and one single 1 µF Tantalum or Ceramic capacitor). Additional precautions can be taken to filter analog noise: V_{DDA} can be connected to V_{DD} through a ferrite bead.

STM8L152xx, STM8AL3Lxx and STM8L162xx devices manage the supply voltage needed by the LCD in three different ways (see *Figure 1*):

1. If the LCD feature is not used, connect the VLCD pin to V_{DD}.
2. Apply to VLCD the voltage to be applied to the LCD.
3. Leave the STM8L152xx/STM8L162xx/STM8AL3Lxx to provide the correct voltage, via its programmable LCD booster, by connecting the VLCD pin to a 1µF capacitor.

Figure 1. Power supply



1. Optional: if a separate, external reference voltage is connected on V_{REF+}, the two capacitors (100 nF and 1 µF) must be connected. V_{REF+} is either connected to V_{DDA} or V_{REF}.
2. N is the number of V_{DD} and V_{SS} inputs.

Note: The capacitors must be connected as close as possible to the device supplies.

Placing a crystal/resonator on OSCIN/OSCOUT is optional. The resonator must be connected as close as possible to the OSCIN and OSCOUT pins. The loading capacitance ground must be connected as close as possible to V_{SS}.

2.2 Main operating voltages

STM8L and STM8AL devices are processed in 0.13 µm technology. The STM8L and STM8AL core and I/O peripherals need different power supplies. In fact, STM8L and STM8AL devices have an internal regulator with a nominal target output of 1.8 V.

2.3 Power-on/power-down reset (POR/PDR)

The input supply to the main and low power regulators is monitored by a power-on/power-down reset circuit. The monitoring voltage begins at 0.7 V.

During power-on, the POR/PDR keeps the device under reset until the supply voltages (V_{DD} and V_{DDA}) reach their specified working area. Maximum power on time $t_{VDD[max]}$ must be respected, as the internal reset provided for supply stabilization is maintained for ~1 ms.

At power-on, a defined reset should be maintained below 0.7 V. The upper threshold for a reset release is defined in the electrical characteristics section of the product datasheets.

A hysteresis is implemented (POR > PDR) to ensure clean detection of voltage rise and fall.

The POR/PDR also generates a reset when the supply voltage drops below the V_{PDR} threshold (isolated and repetitive events).

Correct device reset during power-on sequence is guaranteed when $t_{VDD[max]}$ is respected. It is recommended to use an internal BOR or an external reset circuit (especially for STM8L101xx devices) to ensure correct device reset during power-down when $V_{PDR} < V_{DD} < V_{DD[min]}$.

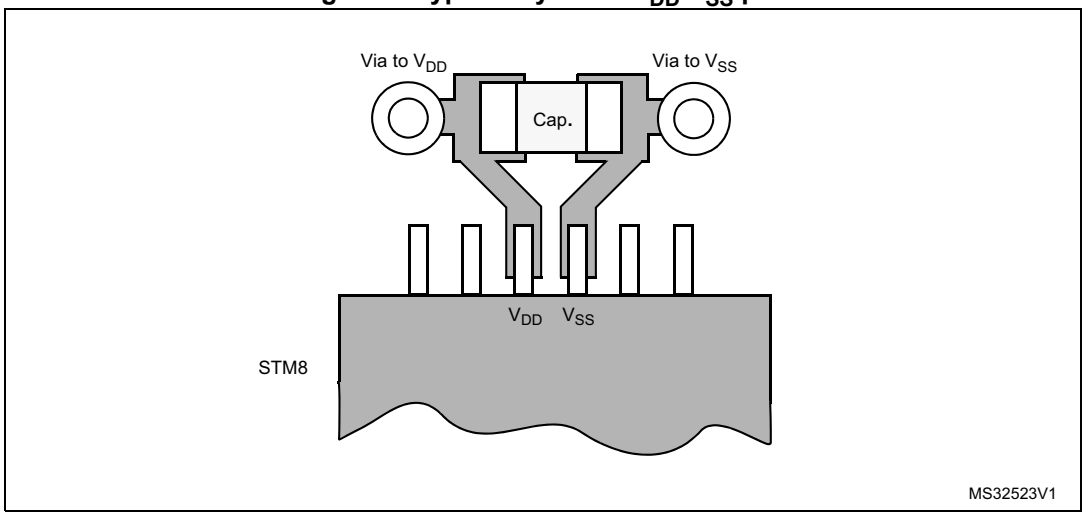
For better power monitoring, the STM8L15xxx, STM8L162xx, STM8AL31xx, and STM8AL3Lxx provide a brown out reset (BOR) and programmable power voltage detection (PVD) for an earlier detection of voltage drop.

Recommendations

All pins need to be properly connected to the power supplies. These connections, including pads, tracks and vias should have the lowest possible impedance. This is typically achieved with thick track widths and preferably dedicated power supply planes in multi-layer printed circuit boards (PCBs).

In addition, each power supply pair should be decoupled with filtering ceramic capacitors (C) at 100 nF with one chemical C (1..2 µF) in parallel on the STM8L/STM8AL devices. The ceramic capacitors should be placed as close as possible to the appropriate pins, or below the appropriate pins, on the opposite side of the PCB. Typical values are 10 nF to 100 nF, but exact values depend on the application needs. *Figure 2* shows the typical layout of such a V_{DD}/V_{SS} pair.

Figure 2. Typical layout of V_{DD}/V_{SS} pair



3 Analog-to-digital converter (ADC)

This section does not apply to STM8L101xx devices.

3.1 Analog power

For some packages, the ADC unit has an independent, analog supply voltage, isolated on input pin V_{DDA}, which allows the ADC to accept a very clean voltage source. This analog voltage, V_{DDA}, should be identical to the digital voltage supply on pin V_{DD}. To filter some noise, a ferrite bead can be added between V_{DD} and V_{DDA}. This ferrite bead should be chosen according to the frequencies to be filtered.

Some packages also provide a separate external analog reference voltage input for the ADC unit on the V_{REF+} pin. This gives better accuracy on low voltage input as follows:

- The V_{REF+} pin can be connected to the V_{DDA} external power supply. If a separate, external reference voltage is applied on V_{REF+}, a 100 nF and a 1 µF capacitor must be connected on this pin. To compensate for peak consumption on V_{REF}, the 1 µF capacitor may be increased to 10 µF when the sampling speed is low. In all cases, V_{REF+} must be kept between 2.4 V and V_{DDA}. If V_{DDA} is below 2.4, V_{REF+} must be equal to V_{DDA}. This input is internally bonded to V_{DDA} in the devices that have no internal V_{REF+} pin.
- V_{REF-} (input, analog reference negative): The lower/negative reference voltage is internally bonded to V_{SSA}.

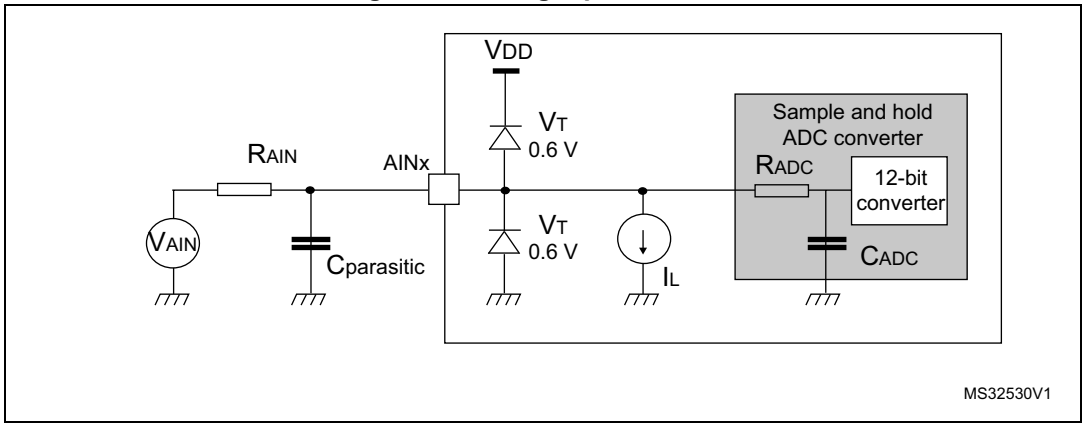
3.2 Analog input

The devices include up to 28 analog input channels (including four fast channels), each multiplexed with an I/O, which are converted by the ADC one at a time.

The external input impedance (R_{AIN}) max value is 50 kΩ. The four fast channels can convert at maximum speed (1 MHz) if R_{AIN} is less than 0.5 kΩ.

Please refer to *Figure 3*.

Figure 3. Analog input interface



Please refer to the applicable datasheets and reference manuals for more details.

4 Clock management

The STM8L101xx devices have no external clock, so no precautionary measures are needed.

4.1 Clock management overview

STM8L05xxx, STM8L15xxx, STM8L162xx, STM8AL31xx and STM8AL3Lxx devices offer a flexible way of selecting the core and peripheral clocks (ADC, memory, and digital peripherals). The devices have internal and external clock source inputs, both of which have a high speed and a low speed version. Any of those four clocks can be use for the CPU and most of the peripherals through a programmable prescaler. An I/O can be programmed as output clock (CCO) to reflect one of the four clocks (with or without prescaling).

The signal which leaves the I/O represents an output clock (CCO) divided by a division factor.

4.2 Internal clocks

STM8L and STM8AL devices have two kinds of internal clock: A high speed internal clock (HSI) running at 16 MHz and a low speed internal clock (LSI) running at 38 kHz.

After reset, the CPU starts with the internal RC (HSI clock signal) divided by 8, i.e. 2 MHz.

4.3 External clock

STM8L05xx, STM8L15xxx, STM8L162xx, STM8AL31xx, and STM8AL3Lxx devices have two kinds of external clock: A high speed external clock (HSE) running at up to 16 MHz and a low speed external clock (LSE) running at 32.768 kHz.

4.3.1 HSE clock

STM8L05xx, STM8L15xxx, STM8L162xx, STM8AL31xx, and STM8AL3Lxx devices can connect to an external crystal or an external oscillator.

Note: When no external clock is used, OSCIN and OSCOUT can be used as general purpose I/Os.

Figure 4 describes the external clock connections.

External clock

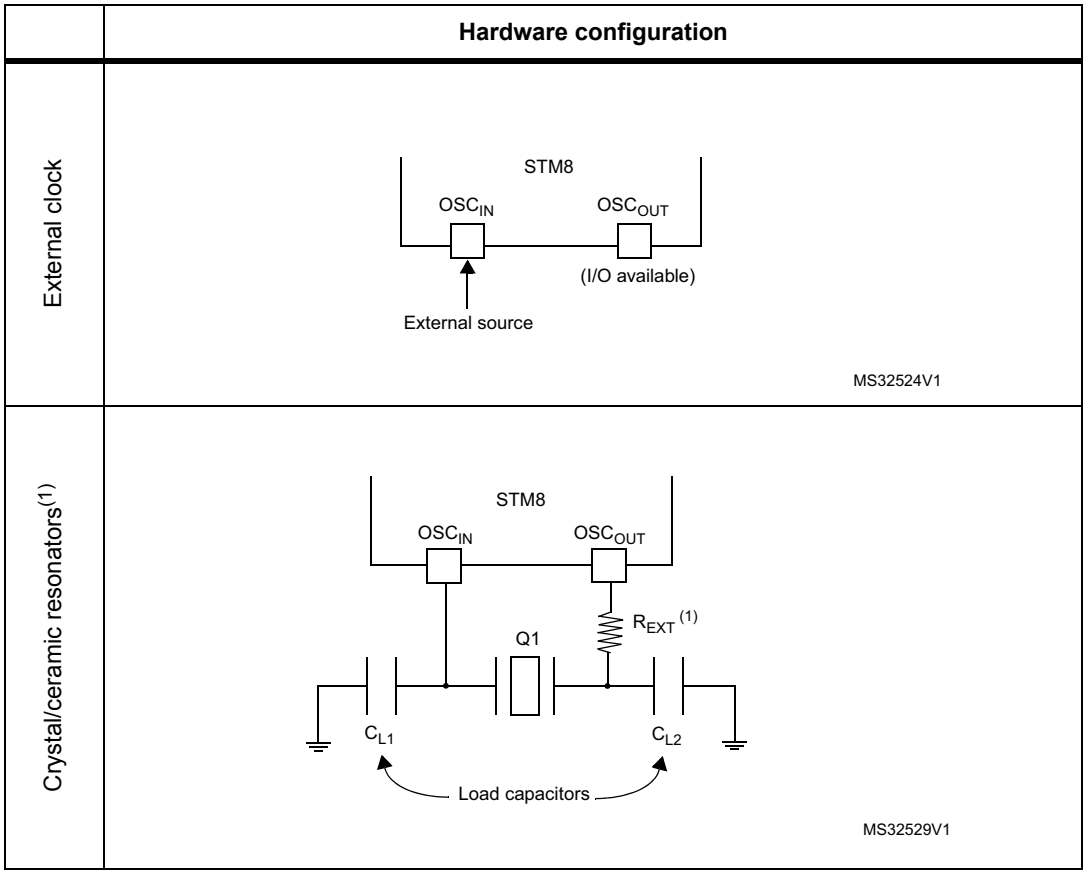
- Frequency: 0 kHz … 16 MHz
- Input hysteresis: 100 mV

Caution: Without prescaler, a duty cycle of 45/55 % maximum must be respected at high speed

Crystal/ceramic resonator

- Frequency range: 1 to 16 MHz
- Stabilization time: Programmable from 1 to 4096 cycles
- Oscillation mode: Preferred fundamental
- Output duty cycle: Max 55/45%
- I/Os: Standard I/O pins multiplexed with OSC_{IN} and OSC_{OUT}
- Cload: 10 to 20 pF
- Drive level maximum: at least 100 µW

Figure 4. HSE clock sources



1. The value of R_{EXT} depends on the crystal characteristics. A 0 Ω resistor works well with most oscillators but, it is not optimal. A typical value is in the range 5 to 6 R_S (resonator series resistance). To fine-tune the R_{EXT} value, refer to AN2867 (Oscillator design guide for ST microcontrollers).

The values of the load capacitors C_{L1} and C_{L2} are heavily dependent on the crystal type and frequency. Refer to the datasheet of the crystal manufacturer to select the capacitances. For best oscillation stability, C_{L1} and C_{L2} normally have the same value. Typical values are in the range from below 20 pF up to 40 pF (cload: 10 to 20 pF). The parasitic capacitance of the board layout also needs to be considered and typically adds a few pF to the component values (refer to AN2867).

A clock security system prevents any CPU fatal error from a HSE failure, as it safely switches to HSI.

Recommendations

In the PCB layout all connections should be as short as possible. Any additional signals, especially those that could interfere with the oscillator, should be locally separated from the PCB area around the oscillation circuit using suitable shielding.

4.3.2 LSE clock

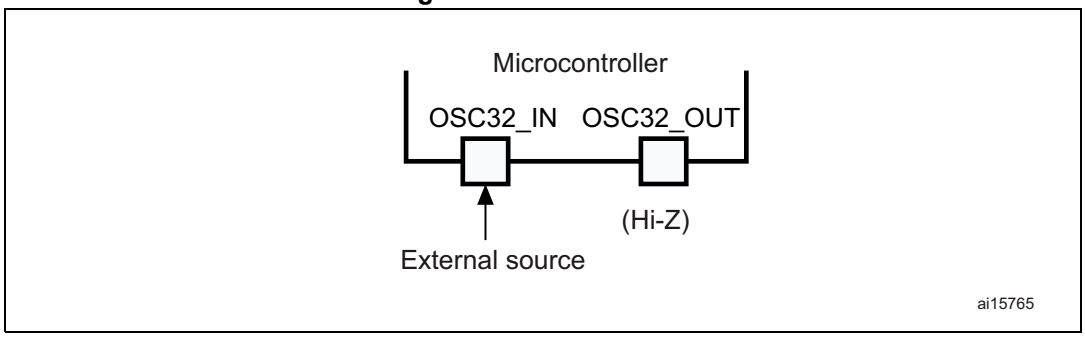
The low-speed external clock signal (LSE) can be generated from two possible clock sources:

- LSE external crystal/ceramic resonator (see *Figure 6*)
- LSE user external clock (see *Figure 6*)

External source (LSE bypass)

In this mode, an external clock source must be provided. It must have a frequency of 32.768 kHz. The external clock signal (square, sine or triangle) with a duty cycle of about 50% has to drive the OSC32_IN pin while the OSC32_OUT pin must be left high impedance (see *Figure 5* and *Figure 6*).

Figure 5. External clock



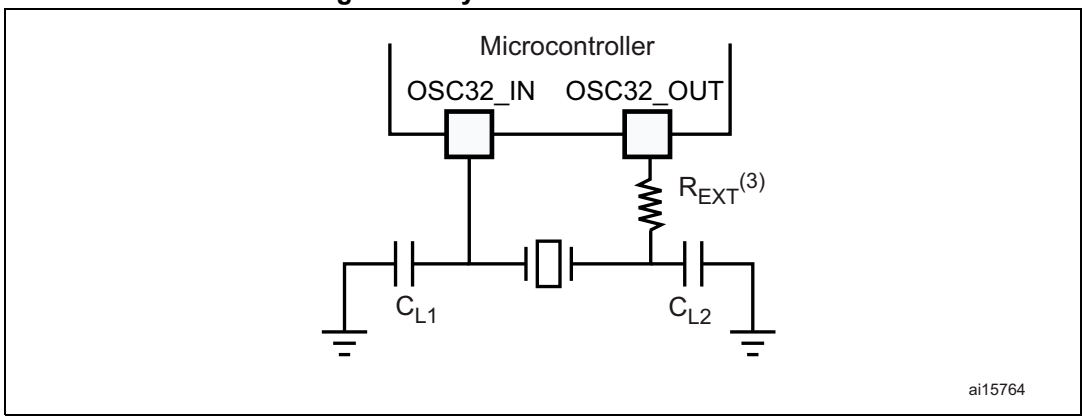
1. OSC32_IN and OSC32_OUT pins can be used also as GPIO but, it is recommended not to use them as both RTC and GPIO pins in the same application.

External crystal/ceramic resonator (LSE crystal)

The LSE crystal is a 32.768 kHz low-speed external crystal or ceramic resonator. It has the advantage of providing a low-power, but highly accurate clock source to the real-time clock peripheral (RTC) for clock/calendar or other timing functions.

The resonator and the load capacitors have to be connected as close as possible to the oscillator pins in order to minimize output distortion and start-up stabilization time. The load capacitance values must be adjusted according to the selected oscillator.

Figure 6. Crystal/ceramic resonators



1. To avoid exceeding the maximum value of C_{L1} and C_{L2} (15 pF), it is strongly recommended to use a resonator with a load capacitance C_L = 7 pF. To fine-tune the choice, refer to the g_{mcrit} calculation in AN2867 (Oscillator design guide for ST microcontrollers).
2. OSC32_IN and OSC32_OUT pins can be used also as GPIO, but it is recommended not to use them as both RTC and GPIO pins in the same application.
3. The value of R_{EXT} depends on the crystal characteristics. A 0 Ω resistor works with most oscillators. A typical value is in the range 5 to 6 R_S. To fine-tune the R_{EXT} value refer to AN2867 (Oscillator design guide for ST microcontrollers).

5 Reset control

5.1 Reset management overview

The reset pin is a 3.3 V bidirectional I/O. After startup it can be programmed by software to be used as a general purpose I/O.

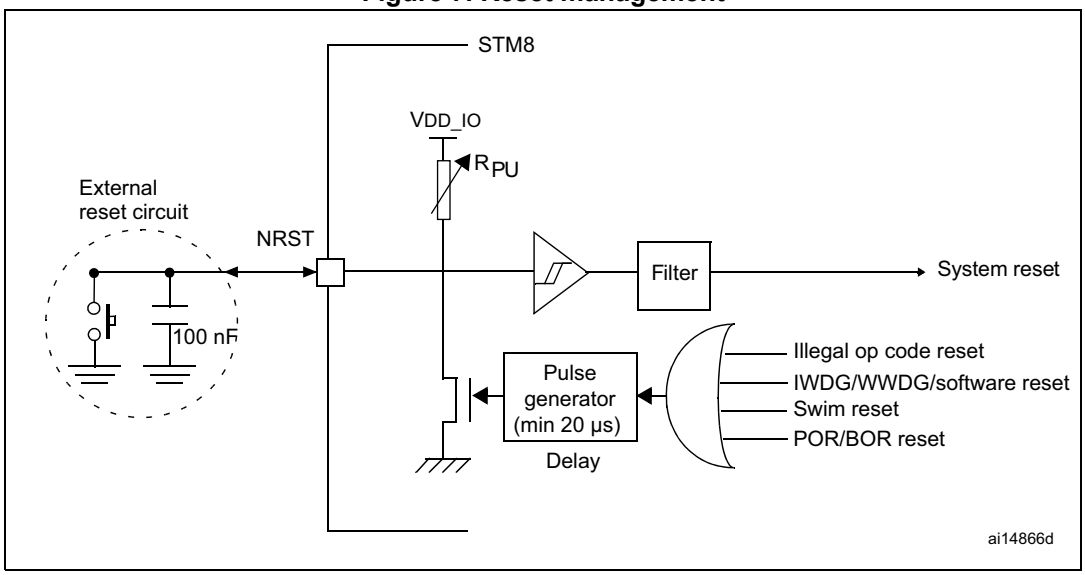
Its output buffer driving capability is fixed to Iol_{MIN} = 2 mA @ 0.45 V in the 1.8 V to 3.6 V range which includes a ~45 k pull-up. Output buffer is reduced to the n-channel MOSFET (NMOS). The receiver includes a glitch filter, whereas the output buffer includes a 20 µs delay.

There are many reset sources, including:

- External reset through the NRST pin
- Power-on reset (POR) and brown-out reset (BOR): During power-on, the POR keeps the device under reset until the supply voltage (V_{DD} and V_{DDx}) reach the voltage level at which level the BOR starts to function. STM8L101xx devices have only a POR.
- Independent watchdog reset (IWDG)
- Window watchdog reset (WWDG), featuring also software reset: only for STM8L05xx, STM8L15xxx, STM8L162xx, STM8AL31xx, and STM8AL3Lxx.
- SWIM reset: An external device connected to the SWIM interface can request the SWIM block to generate a microcontroller reset.
- Illegal opcode reset: If a code to be executed does not correspond to any opcode or prebyte value, a reset is generated.

Figure 7 shows a simplified functional I/O reset schematic.

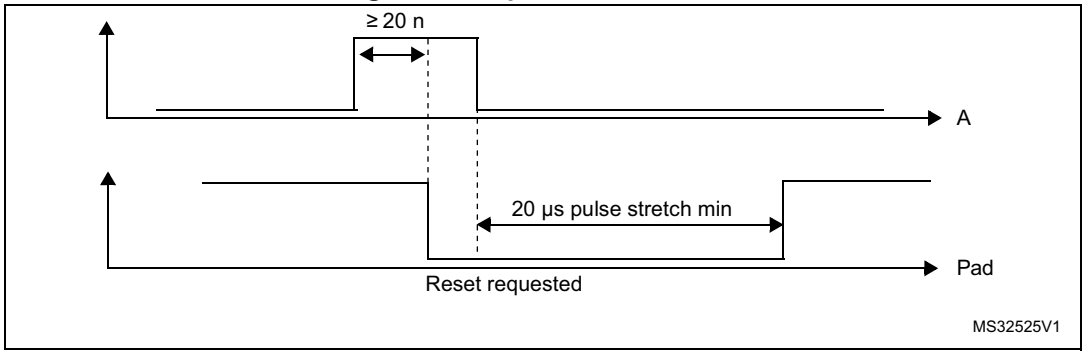
Figure 7. Reset management



5.1.1 Output characteristics

- A valid pulse on the pin is guaranteed with a ≥ 20 ns pulse duration on the internal output buffer.
- After a valid pulse is recognized, a pulse on the pin of at least 20 µs is guaranteed starting from the falling edge of A.

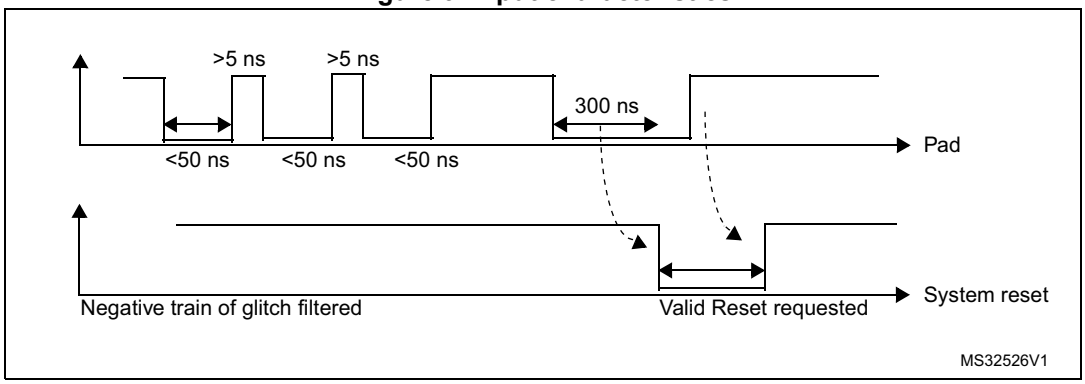
Figure 8. Output characteristics



5.1.2 Input characteristics

- All pulses with a duration less than 50 ns are filtered
- All train/burst spikes with a ratio of 1/10 must be filtered. This means that a negative spike of up to 50 ns is always filtered, when a 5 ns interval between spikes occurs (ratio 1/10).
- All pulses with duration more than 300 ns are recognized as valid pulses

Figure 9. Input characteristics



5.2 Hardware reset implementation

The STM8L and STM8AL do not require an external reset circuit to power-up correctly. Only a pull-down capacitor is recommended (see *Figure 7*). However, charging/discharging the pull-down capacitor through an internal resistor has a negative influence on the device power consumption. Therefore, the recommended capacitor value of 100 nF can be reduced down to 10 nF to limit such power consumption.

The STM8L101xx reset state is released 1 ms after the POR value (1.35 V to 1.65 V) is reached. At this time, V_{DD} should be in the 1.65 V to 3.6 V range.

For medium density devices and medium+ and high density devices operating from 1.8 V at power-on: the reset state is released 1 ms after the BOR minimum value (~1.75 V) is reached.

6 Recommendations

6.1 Printed circuit board

For technical reasons, it is best to use a multi-layer PCB with a separate layer dedicated to the V_{SS} and another layer to the V_{DD} supply. This results in a good decoupling, as well as a good shielding effect. For many applications, economical requirements prohibit the use of this type of board. In this case, the most important feature is to ensure a good structure for the V_{SS} and power supply.

6.2 Component position

A preliminary layout of the PCB must separate the different circuits according to their electromagnetic interference (EMI) contribution. This reduces cross-coupling on the PCB, for instance, noisy, high-current circuits, low voltage circuits, and digital components.

6.3 Ground and power supply (V_{SS}, V_{DD})

The V_{SS} should be distributed individually to every block (noisy, low level sensitive, and digital) with a single point for gathering all ground returns. Loops must be avoided or have a minimum surface. The power supply should be implemented close to the ground line to minimize the surface of the supply loop. This is due to the fact that the supply loop acts as an antenna, and is therefore the main emitter and receiver of EMI. All component-free surfaces of the PCB must be filled with additional grounding to create a kind of shield (especially when using single-layer PCBs).

6.4 Decoupling

The standard decoupler for the external power is a 1 µF pool capacitor**.** Supplementary 100 nF capacitors must be placed as close as possible to the V_{SS}/V_{DD} pins of the microcontroller to reduce the area of the current loop.

As a general rule, decoupling all sensitive or noisy signals improves electromagnetic compatibility (EMC) performances.

There are two types of decouplers:

- Capacitors close to components. Inductive characteristics, which apply to all capacitors beyond a certain frequency, must be taken into account. If possible, parallel capacitors with decreasing values (0.1, 0.01,... µF) should be used.
- Inductors. Although often ignored, ferrite beads, for example, are excellent inductors due to their good dissipation of EMI energy and there is no loss of DC voltage (which is not the case when simple resistors are used).

6.5 Other signals

When designing an application, the following areas should be closely studied to improve EMC performances:

- Noisy signals (clock)
- Sensitive signals (high impedance)
- Signals for which a temporary disturbance permanently affects operation of the application, for example, interrupts and handshaking strobe signals (but not LED commands).

A surrounding V_{SS} trace for such signals increases EMC performances, as does a shorter length or absence of noisy and sensitive traces (crosstalk effect).

For digital signals, the best possible electrical margin must be reached for the two logical states. Slow Schmitt triggers are recommended for eliminating parasitic states.

6.6 Unused I/Os and features

Microcontrollers are designed for a variety of applications, where often a particular application does not use 100 % of the microcontroller resources.

To avoid unnecessary power consumption (especially important for battery powered applications) and also to improve EMC performance, unused clocks, counters, or I/Os, should not be left free, I/Os should be forced externally (pull-up or pull-down to the unused I/O pins), and unused functions should be ‘frozen’ or disabled.

Alternatively, unused I/Os can be programmed as push-pull ‘low’ to keep them at a defined level without using external components. However in this case, the I/O is not driven during the power up phase, until the I/O is configured. This can add a little extra power consumption, and may be undesirable in very power sensitive applications.

6.7 User options

STM8L and STM8AL devices have user option features that can be used for remapping or enabling/disabling an automatic reset or low speed watchdog. For more details, please refer to the product datasheets.

6.8 Bootloader

STM8L05xx, STM8L15xxx, STM8L162xx, STM8AL31xx, and STM8AL3Lxx devices have a bootloader embedded in a ROM memory. Through this firmware the device memory can be re-programmed via:

- USART communication interface for medium density devices
- USART1, USART2, USART3, SPI1, and SPI2 communication interfaces for medium+ and high density devices.

7 Reference design

7.1 Component references

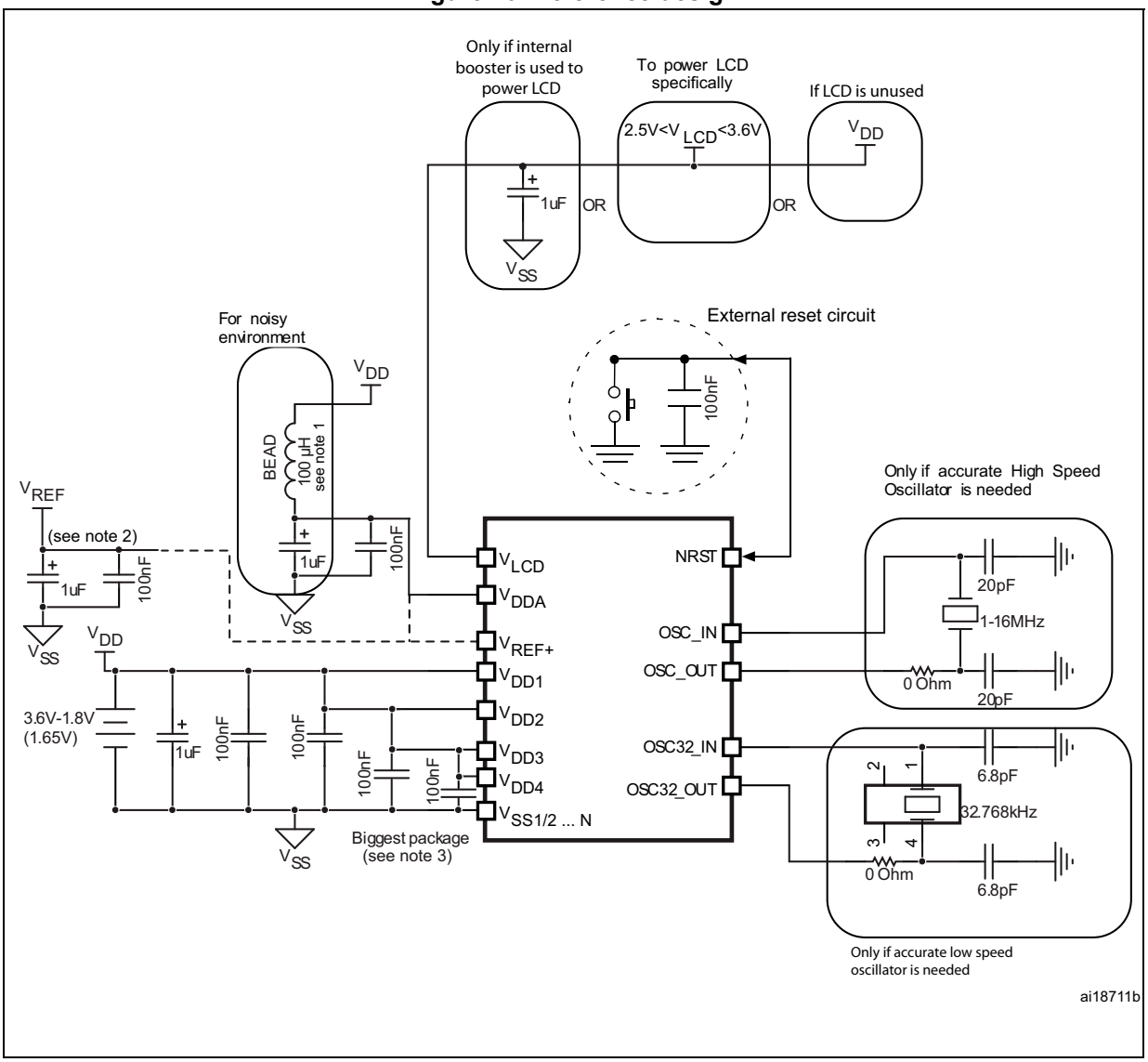
Table 2. Component list

ID	Component name	Reference	Quantity	Comments
1	Microcontroller	STM8L, STM8AL	1	Refer to the ‘pinouts and pin description’ and ‘package characteristics’ sections of the STM8L and STM8AL datasheets, to choose the right package
2	Battery	1.65 V to 3.6 V(1)	1	Min 1.8 V when BOR is enabled
3	Capacitor	1 µF	n	Decoupling capacitor
4	Capacitor	100 nF	n	Ceramic capacitor (decoupling capacitor)
Components below are optional				
5	Capacitor	10 µF	1	Ceramic capacitor (decoupling capacitor)
6	Crystal	1 to 16 MHz	1	-
7	Capacitor	20 to 40 pF	2	Used for crystal
	Crystal	32 kHz	1	-
8	Capacitor	5 to 20 pF	2	Used for crystal
	Ferrite bead			Depends on noise to be filtered
9	SWIM connector	4 pins	1	-

1. 1.8 V to 3.6 V for STM8L05xxx.

7.2 Schematics

Figure 10. Reference design



1. If these components are removed, they have to be replaced by a short connection.
2. Optional: if a separate, external reference voltage is connected on V_{REF+}, the two capacitors (100 nF and 1 µF) must be connected. V_{REF+} is either connected to V_{DDA} or V_{REF}.
3. One 100 nF Ceramic capacitor for each VDDx pin and one single 1 µF Tantalum or Ceramic capacitor.

8 STM8 development tools

Typically, the following tools are needed to get started:

- STVD for integrated development environment
- STM8 C compiler (from Cosmic, Raisonance, or IAR)
- ST toolset and STM8 firmware library from STMicroelectronics
  STM8L101xx standard peripheral library,
  STM8L05x/STM8L15x/STM8L16x/STM8AL31x/STM8AL3Lx standard peripheral library
- STM8 evaluation board from STMicroelectronics (STM8L101-EVAL for STM8L101xx, STM8L1526-EVAL for medium density STM8L15xxx and STM8AL31xx/STM8AL3Lxx, and STM8L1528-EVAL for high density STM8L15xxx/STM8L162xx)
- If you use STM8L101-EVAL, you also need the HW SWIM debug interface "Rlink" from Raisonance and ST-Link or STice-SWIM. The debug interface ST-LINK is included in STM8L1526-EVAL and STM8L1528-EVAL.
- STM8L-DISCOVERY

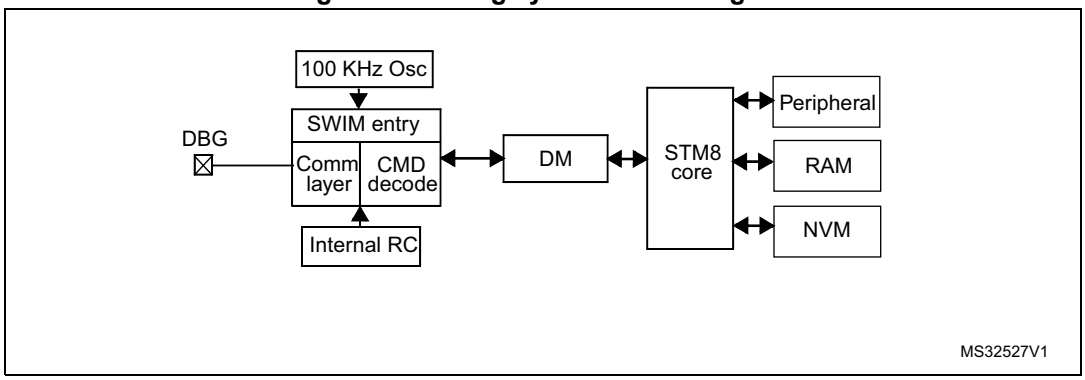
8.1 Single wire interface module (SWIM)

8.1.1 SWIM overview

In-circuit debugging mode or in-circuit programming mode are managed through a single wire hardware interface based on an open-drain line, featuring ultra fast memory programming. Coupled with an in-circuit debugging module, the SWIM also offers a non-intrusive read/write to RAM and peripherals. This makes the in-circuit debugger extremely powerful and close in performance to a full-featured emulator.

The SWIM pin can be used as a standard I/O (with 8 mA capability) which has some restrictions if the user wants to use it for debugging. The most secure way to use it is to provide a strap option on the PCB. Please refer to the STM8 SWIM communication protocol and debug module user manual (UM0470) for more SWIM protocol details.

Figure 11. Debug system block diagram



8.1.2 SWIM connector pins

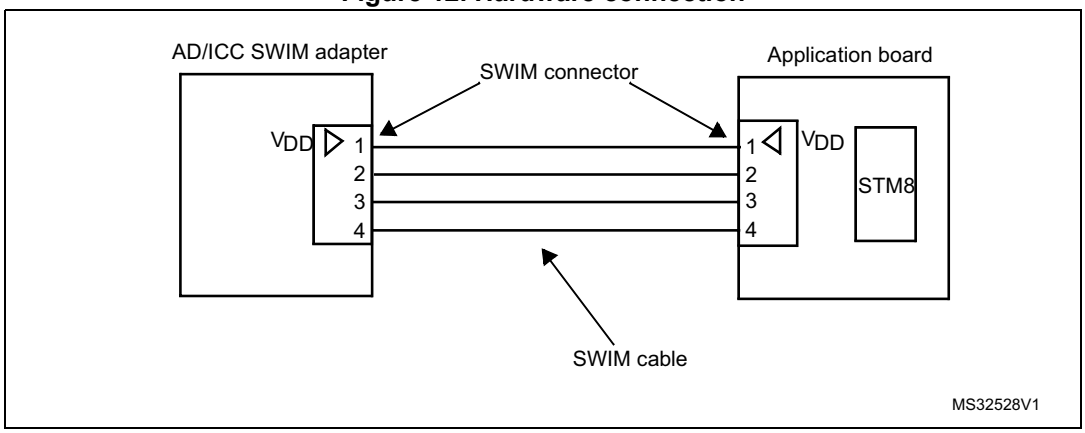
The SWIM connector pins consist of four pins as described in *Table 3*.

Table 3. SWIM connector pins

Pin number	Pin name
Pin 1	V_{DD}
Pin 2	SWIM pin
Pin 3	V_{SS}
Pin 4	Reset

8.1.3 Hardware connection

Figure 12. Hardware connection



Caution: It is recommended to place the SWIM header as close as possible to the STM8L/STM8AL device, as this minimizes any possible signal degradation caused by long PCB tracks.

8.2 STice emulator

8.2.1 STice overview

The STice is a modular, high-end emulator system which connects to the PC via a USB interface, and to the application board in place of the target microcontroller.

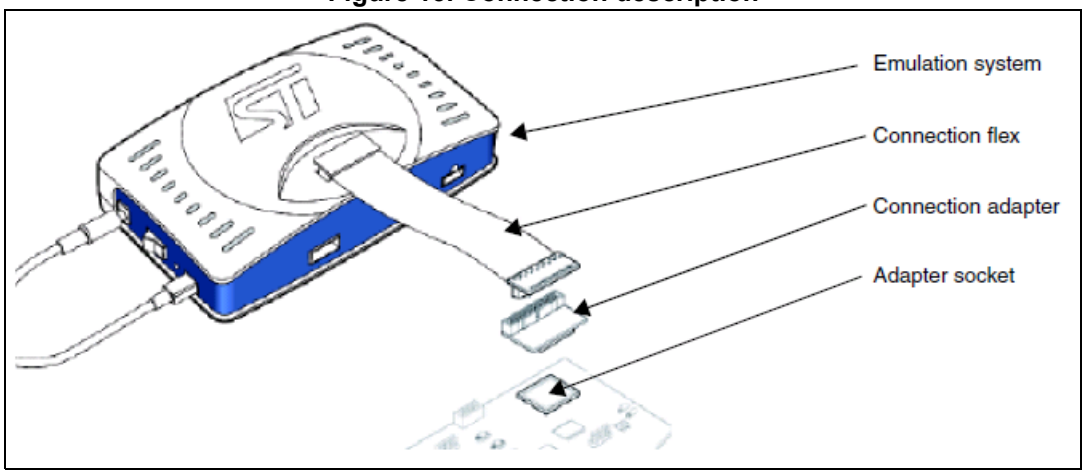
It is supported by the free STM8 toolset: IDE ST Visual Develop (STVD) programmer, ST Visual Programmer (STVP) and STM8 Assembler. Please refer to the STice emulator for STM8 for more details.

STice has two distinct modes of operation which are described further in this section:

- Emulation mode
- In-circuit mode

It can also be used instead of RLink for SWIM connection.

Figure 13. Connection description



Emulation system: STice

- Emulator box
- Cables for USB, power supply, trigger, and analyzer input

Connection flex

- 60-pin or 120-pin cable for connection to the application board

Connection adapter

- Links the connection flex to the footprint of the STM8L/STM8AL microcontroller

Adapter socket

- Package-specific socket for connection adapter and STM8L/STM8AL microcontroller

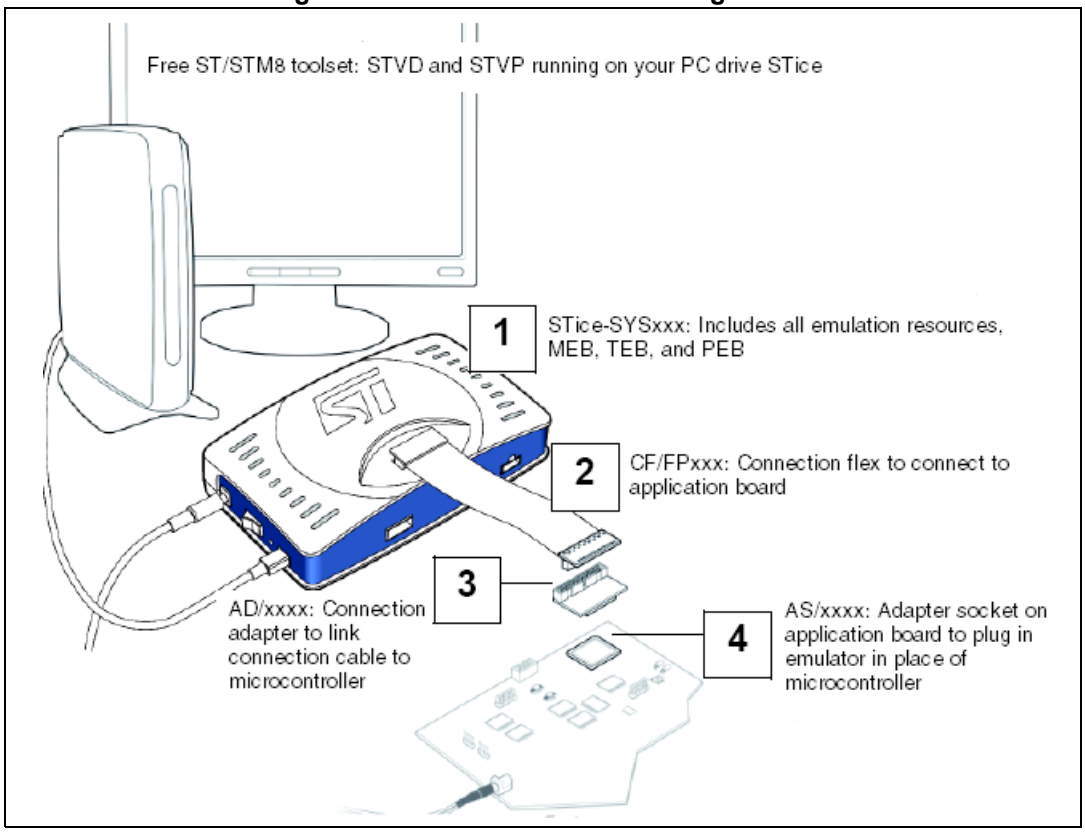
8.2.2 STice in emulation configuration

In emulation configuration, the STice is connected to the PC via a USB interface and to the application board in place of the target microcontroller being used.

- Connection flex: Flexible cable (60-pin or 120-pin depending on the target microcontroller) that relays signals from the STice to the application board.
- Connection adapter: Links the connection flex to the footprint of the target microcontroller on the users application board.
- Adapter socket: Socket that solders to the application board in place of the microcontroller and receives the connection adapter.

The above accessories are not included with the STice system. **To determine exactly what is required for any supported microcontroller, refer to the online product selector on *www.st.com*.**

Figure 14. STice in emulation configuration

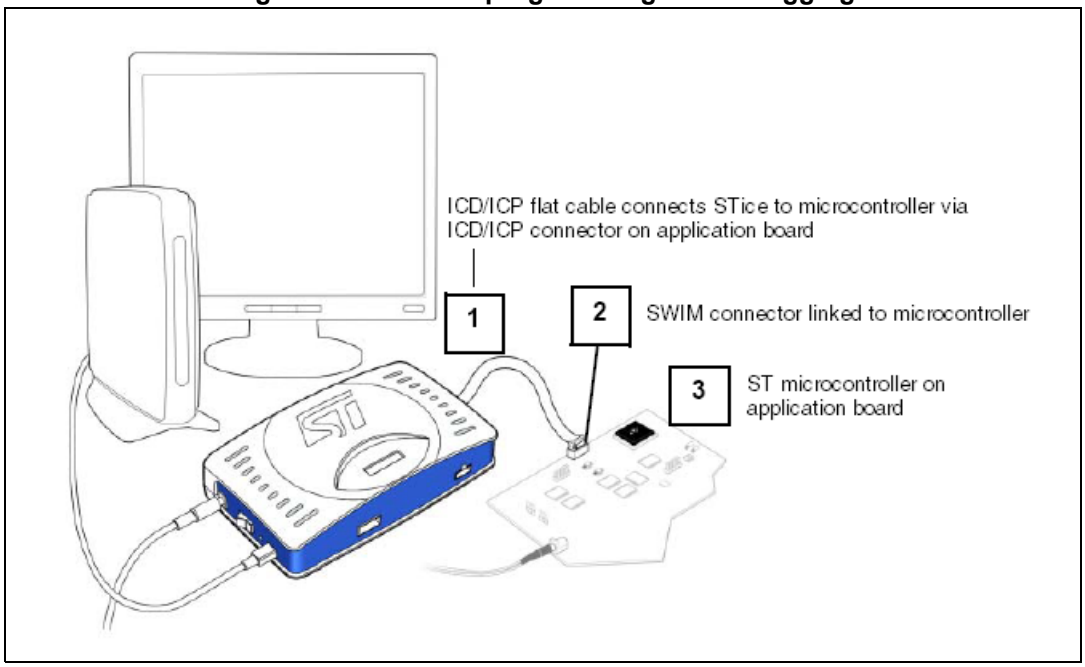

Free ST/STM8 toolset: STVD and STVP running on your PC drive STice
1
STice-SYSxxx: Includes all emulation resources, MEB, TEB, and PEB
2
CF/FPxxx: Connection flex to connect to application board
3
AD/xxxx: Connection adapter to link connection cable to microcontroller
4
AS/xxxx: Adapter socket on application board to plug in emulator in place of microcontroller

8.2.3 In-circuit programming and debugging

In the in-circuit debugging/programming configuration, STice allows the application to be programmed in the microcontroller and for the application to be debugged while it runs on the microcontroller on the application board. STice supports the SWIM protocol, making it possible to in-circuit program and debug the microcontroller using only one general purpose I/O.

In both the emulation and the in-circuit programming/debugging configuration, STice is driven by the ST Visual Develop (STVD) or ST Visual Programmer (STVP) integrated development environment running on the host PC. This provides total control of advanced application building, debugging and programming features from a single easy-to-use interface.

Figure 15. In-circuit programming and debugging


ICD/ICP flat cable connects STice to microcontroller via ICD/ICP connector on application board
1
2
SWIM connector linked to microcontroller
3
ST microcontroller on application board

8.3 RLink and STLink

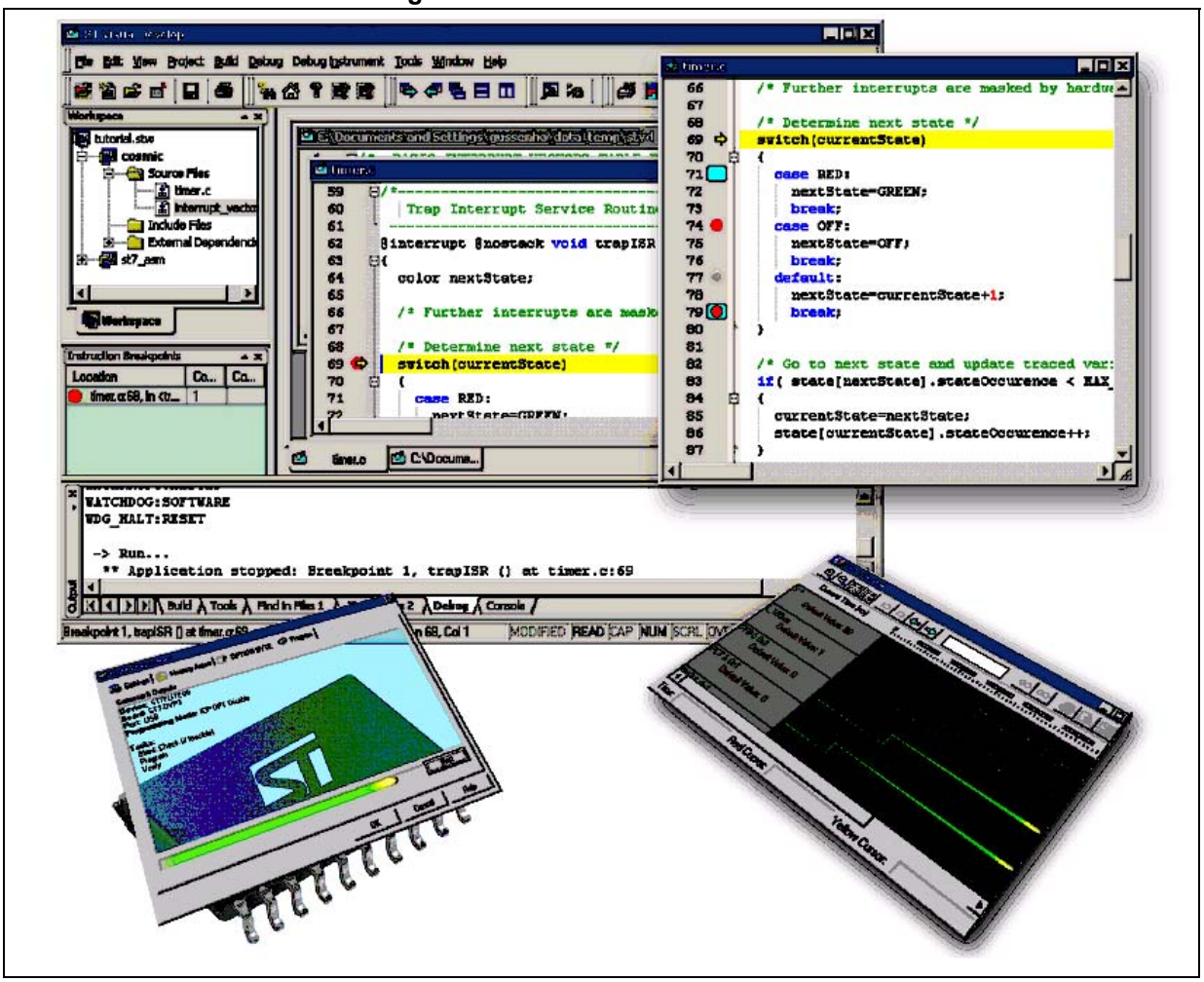
RLink and STLink are debug tools that allow the STM8L evaluation board or any user application board with the SWIM interface to be connected to a host PC via USB for debugging and programming. See *Section 10.3.3: Connecting the hardware on page 34*.

9 STM8 software toolchain

To write, compile and run the first software on an STM8L/STM8AL device, the following components of the software toolchain are required (see *Figure 16*):

- Integrated development environment
- Compiler
- Firmware library (optional, used to ease the startup)

Figure 16. STM8 software toolchain



9.1 Integrated development environment

The integrated development environment ST Visual Develop (STVD) provides an easy-to-use, efficient environment for start-to-finish control of application development, from building and debugging the application code to programming the microcontroller. STVD is delivered as part of the free ST toolset, which also includes the ST Visual Programmer (STVP) programming interface and ST Assembler-Linker.

To build applications, STVD provides seamless integration of C and assembly tool chains for ST including the Cosmic and Raisonance C compilers and ST Assembler-Linker. When debugging, STVD provides an integrated simulator (software) and supports a complete range of hardware tools including the low-cost RLink in-circuit debugger/programmer, the high-end STice emulator, and the low-cost ST-LINK tool.

To program applications to an STM8L/STM8AL, the STVD also provides an interface for reading from the microcontroller memories, writing to them and verifying them. This interface is based on the ST Visual Programmer (STVP), and supports all the target devices and programming tools supported by STVP.

The free ST toolset for STM8 is available from STMicroelectronics homepage (see *www.st.com*).

9.2 Compiler

STM8L/STM8AL devices can be programmed by a free assembler toolchain which is included in the ST toolset.

As the core is designed for optimized high-level-language support, use of a C compiler is recommended!

C compilers for STM8 are offered by the third party companies Cosmic, Raisonance, and IAR.

A free version of the C compiler with up to 32 Kbytes of generated code is available at: www.cosmic-software.com and www.raisonance.com.

9.3 Firmware library

The STM8 firmware library is a complete set of source code examples for each STM8 peripheral. It is written in strict ANSI-C and it is fully MISRA C 2004 compliant.

All examples can be used with four workspace and project definition files, one for STVD and Cosmic C compiler, one for STVD and raisonance Compiler, one for Raisonance integrated debugging environment and compiler (RIDE7 IDE), and one for IAR embedded workbench for STM8 (EWSTM8). This enables the user to load and compile them easily into their preferred development environment.

The examples run on the STMicroelectronics STM8L evaluation board and can be tailored easily to other types of hardware.

For additional information and download of the STM8L/STM8AL firmware library connect to www.st.com/mcu.

10 Setting up the STM8 development environment

10.1 Installing the tools

All software tools are delivered with a setup wizard which guides the user through the installation process. It is recommended to install the tools in the following order:

1. C compiler
2. ST toolset
3. STM8 firmware library

ST-LINK does not need any dedicated software installation in the STM8 development environment because the necessary drivers are delivered with the ST toolset.

The R-link drivers must be launched separately as follows:
Start/Programs/STtoolset/Setup/Install Rlink driver.

10.2 Using the tools

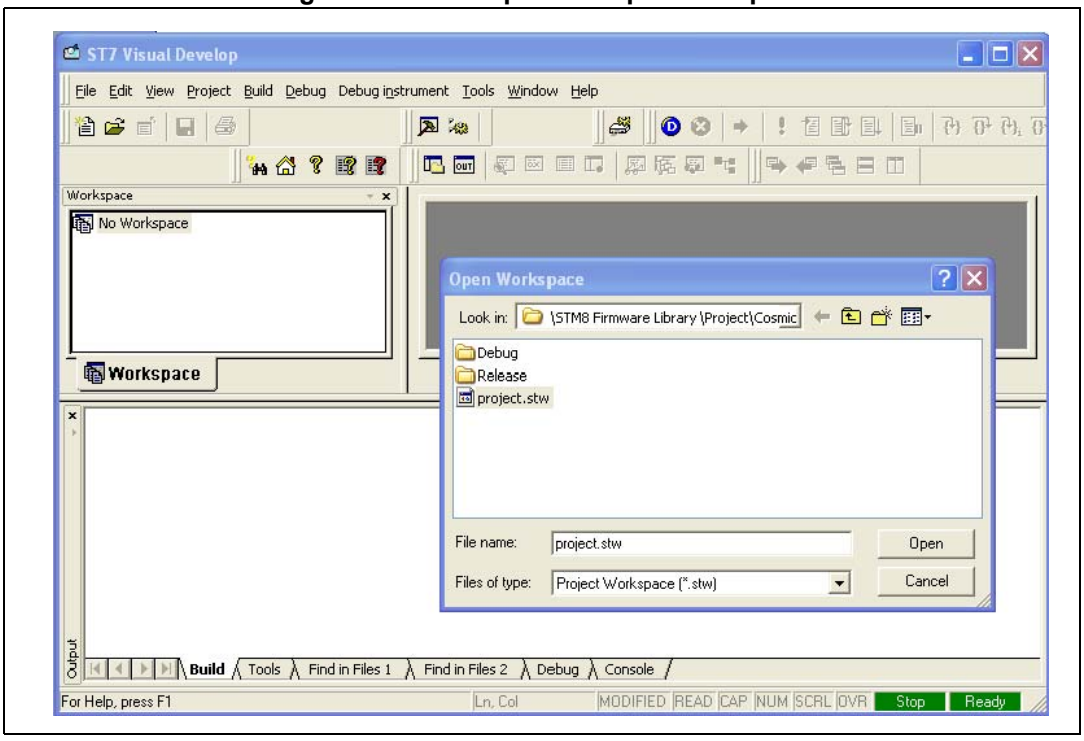
Once the tools installation is complete, the ST Visual Develop (STVD) integrated development environment can be launched.

The user then has the choice to generate either a new workspace with a new project or to open an existing workspace. If using the STVD for the first time, it is recommended to open an existing project from the STM8 firmware library.

Note: Even if you are not intending to use the library, an existing library project can be used as a template to configure all the compiler options. Enter your own code after main().

The STM8 firmware library includes several examples for each peripheral plus one workspace containing a blank project which is ready to receive your C code. It is located in the firmware subdirectory \Project\Template (see *Figure 17*). You can choose between STVD\Cosmic, STVD\Raisonance, RIDE, or EWSTM8.

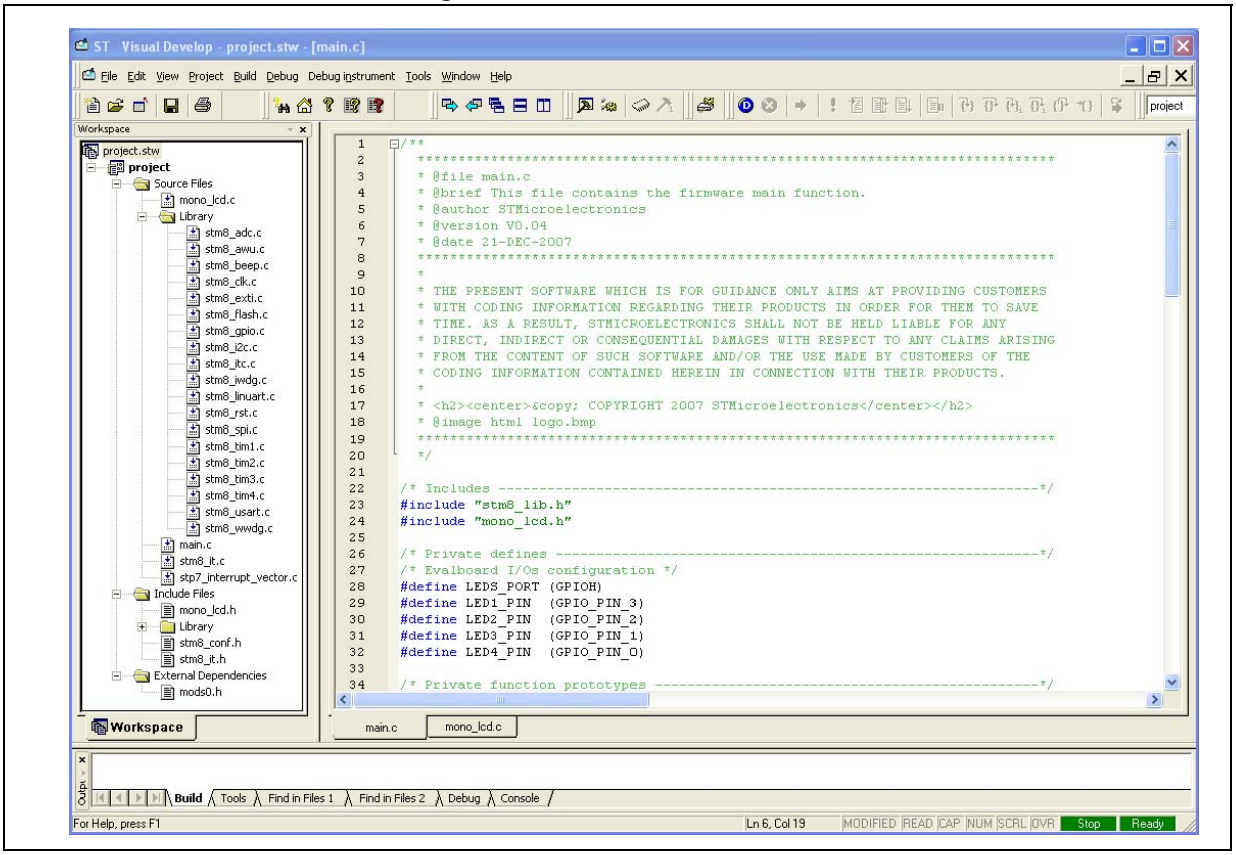
Figure 17. STVD open example workspace



10.2.1 Project editing

All project source files are visible and can be edited (see *Figure 18*).

Figure 18. STVD MCU edit mode



10.2.2 Online help

An online help manual is available inside the firmware installation directory (see *Figure 19*) to help the user understand the structure of the STM8 firmware library.

Figure 19. STM8 firmware library online help manual

10.3 Running the demonstration software

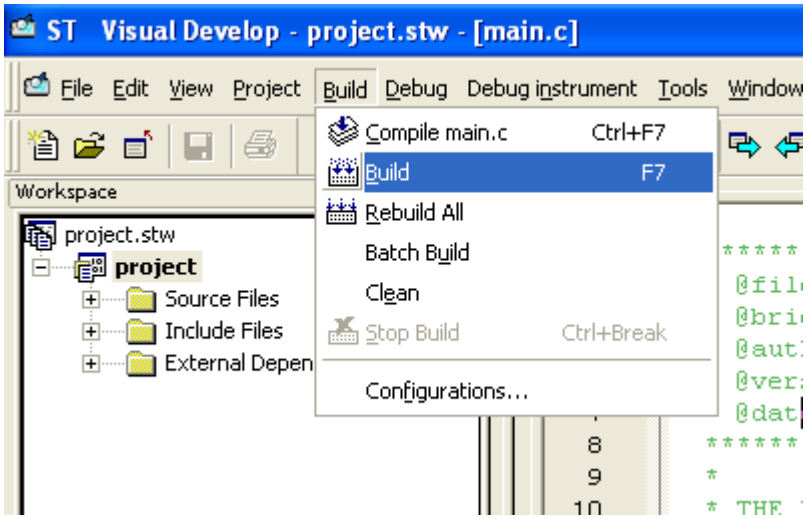
- Go to www.st.com/mcu and search for STM8L/STM8AL products
- Choose STM8L1x-EVAL, STM8L1526-EVAL, or STM8L1528-EVAL firmware
- Open the desired project workspace within the chosen demonstration firmware package.

To run the demonstration software on the STM8 evaluation board, the project has to be compiled and the correct HW tool must be selected before the debug session can be started.

10.3.1 Compiling the project

The project can be compiled using the 'Build' function in the 'Build' menu (see *Figure 20*).

Figure 20. STVD: Building the project

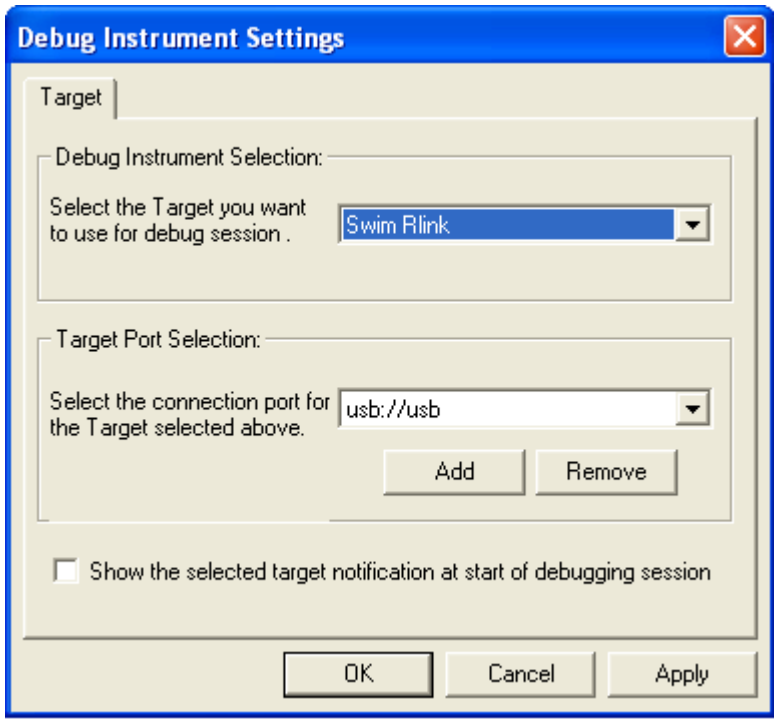


10.3.2 Selecting the correct debug instrument

In the example below, the Rlink tool is used for communicating via the SWIM interface with the on-board debug module of the STM8.

The Rlink tool can be selected from the ‘Debug Instrument Selection’ list in the ‘Debug Instrument Settings’ dialog (see *Figure 21*).

Figure 21. STVD: Selecting the debug instrument



10.3.3 Connecting the hardware

The debug tool, STLink, is included on the STM8L1526-EVAL and STM8L1528-EVAL boards. You can connect the PC to the USB connector. This connection ensures the debug connection and the power. If the jumpers on the boards are no longer in the default position, please read the evaluation board user manuals to select power and debug support jumpers.

For the STM8L101-EVAL, the Rlink tool can be connected to the PC by a standard USB connection. It is also powered by the USB interface. On the controller side, the connection to the STM8 evaluation board is made using the SWIM interface cable. The STM8L101-EVAL, evaluation board is powered by an external 5 V supply (see *Figure 22*).

Figure 22. Connecting the debug instrument to the STM8L101-EVAL evaluation board

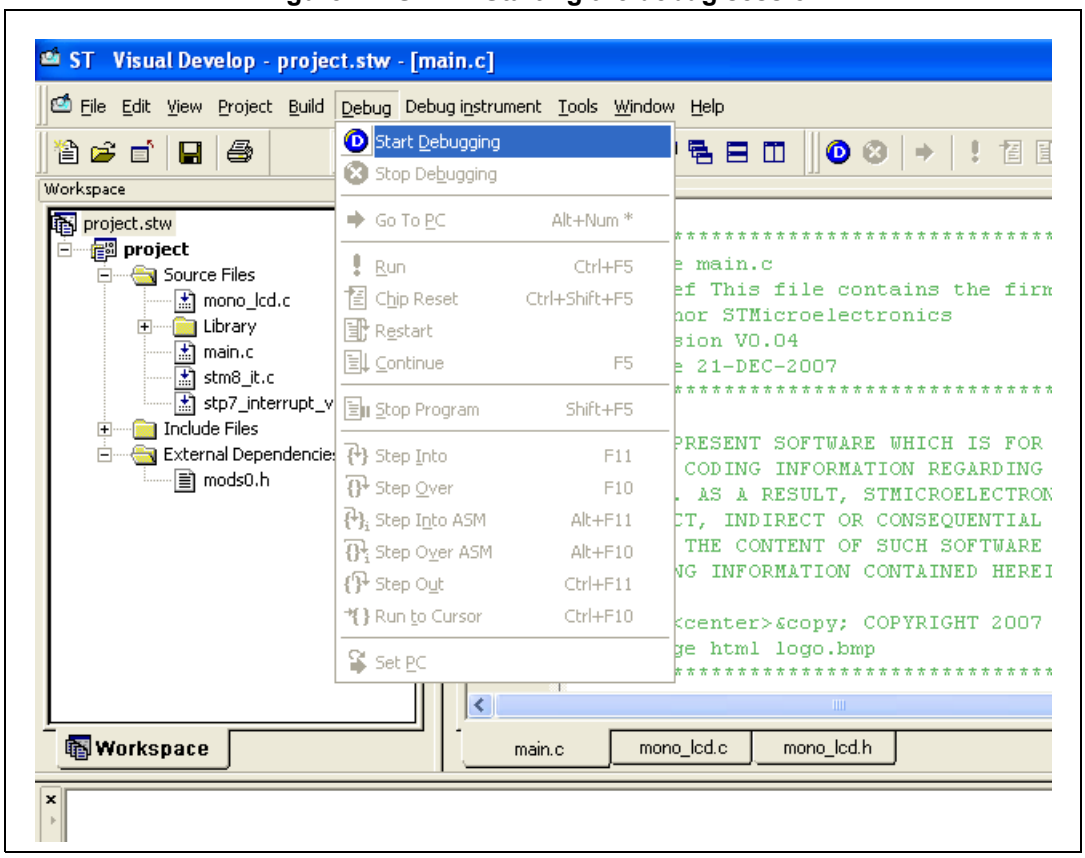
Figure 23. Connecting the debug instrument to the STM8L152x-EVAL evaluation board

Caution: On the Rlink adapter board for STM8, the “SWIM” jumper must be set. If there is no pull-up on the application SWIM line, the “ADAPT” jumper is also set. The “PW-5V” and “12MHz” jumpers must not be set.

10.3.4 Starting the debug session

Debug mode can be entered by the command ‘Debug Start Debugging’ (see *Figure 24*).

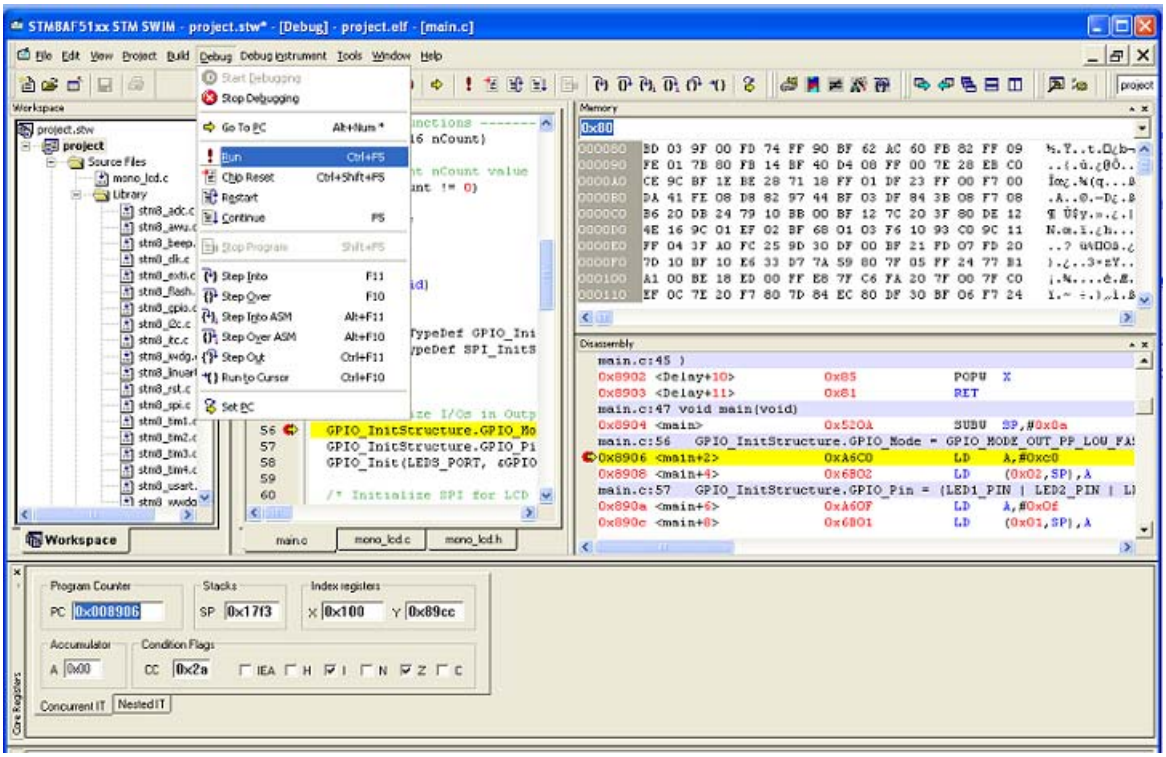
Figure 24. STVD: Starting the debug session



10.3.5 Running the software

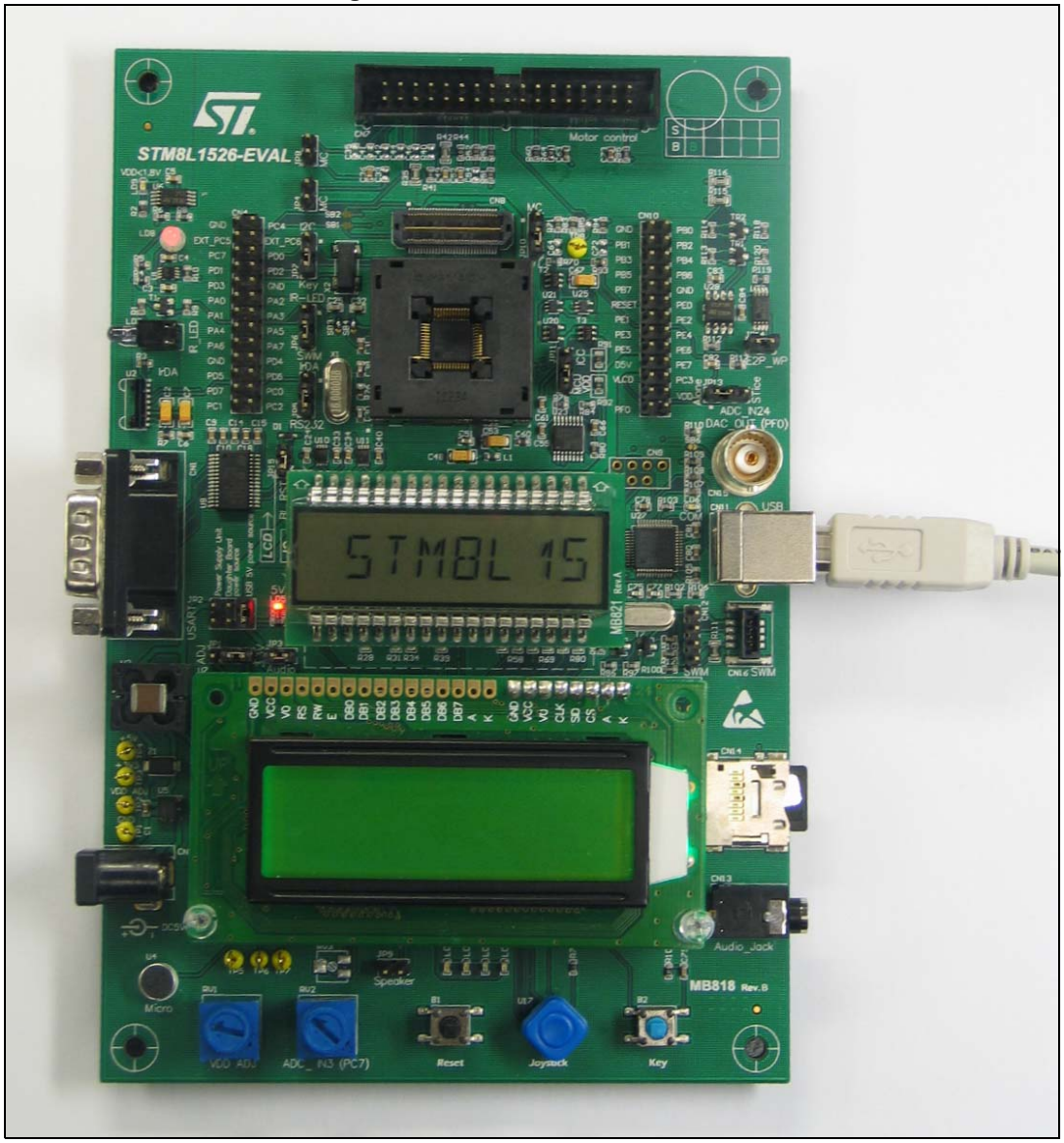
After entering debug mode, the software can be started by the run command in the menu ‘Debug Run’ (see *Figure 25*).

Figure 25. STVD: Run the software



The LCD display on the STM8 evaluation board indicates a successful debug session (see *Figure 26*).

Figure 26. STM8 evaluation board



10.3.6 Follow up

Step by step, additional peripherals of STM8L/STM8AL devices can be run, following on from the initial debug session described above.

Many features of STM8L/STM8AL devices are supported by dedicated hardware on the STM8 evaluation board. The necessary software drivers, including STM8L/STM8AL peripheral drivers (USART, ADC, SPI) and drivers for the EVAL board modules (LCD, serial memory), are delivered in the STM8L1x firmware library.

11 Documentation and online support

Documentation resources related to tool usage includes:

Application

- STM8L/STM8AL datasheets
- How to program STM8L Flash program memory and data EEPROM (PM0054)
- STM8 CPU programming manual (PM0044)
- STM8L05xx, STM8L15xx, STM8L162x, STM8AL31xx and STM8AL3Lxx microcontroller family (RM0031)
- STM8L101xx microcontroller family (RM0013)

Tools

- STM8L/STM8AL firmware library and release note (detailed descriptions of the library are included as help files)
- STice advanced emulation system for ST microcontrollers data briefing
- STice user manual
- Cosmic, Raisonance, or IAR C compiler user manual
- STM8L101-EVAL, STM8L1526-EVAL, or STM8L1528-EVAL evaluation board user manual.
- STM8L1x-EVAL, STM8L1526-EVAL, or STM8L1528-EVAL firmware
- ST Visual Develop tutorial (included as help files in the ST-toolchain)
- ST Visual Develop (STVD) user manual
- STM8 SWIM communication protocol and debug module user manual (UM0470)

The microcontroller discussion forum on *www.st.com* can be used by developers to exchange ideas. It is the best place to find different application ideas. In addition, the website has a knowledge base of FAQs for microcontrollers, which provide answers to many queries and solutions to many problems.

12 Revision history

Table 4. Document revision history

Date	Revision	Changes
09-Sep-2009	1	Initial release
16-Sep-2010	2	Updated all sections and references for medium density, medium+ density and high density devices. Added STM8L16x devices. Replaced V_{DDIO} and V_{SSIO} by V_{DDx} and V_{SSx} respectively. Replaced 48-pin package by “some packages”. Added IAR C compiler. *Section 2.1: Power supply overview*: updated text. *Figure 1*: added note 2; removed the + sign on the VLCD cappa. *Crystal/ceramic resonator*: added reference to AN2867. *Section 3.2: Analog input*: updated text. *Section 4.3.2: LSE clock*: re-arranged section. *Section 5.1: Reset management overview*: removed bullet “electromagnetic susceptibility (EMS) reset (present only on STM8S family). *Figure 7*: removed EMS reset; added external reset circuit. *Section 5.2: Hardware reset implementation*: added text about the pull-down capacitor. *Table 2: Component list*: updated “comment” information for ID number 2 (battery); added ID number 5 (ceramic capacitor). *Figure 10*: added external reset circuit and note 1. *Section 9.2: Compiler*: updated “16 Kbytes” with “32 Kbytes” of generated code. *Section 9.3: Firmware library*: updated text explaining the workspace and project definition files. *Section 10: Setting up the STM8 development environment*: removed introductory text. *Section 10.2: Using the tools*: added EWSTM8.
07-Mar-2011	3	*Figure 1*: updated figure content and footnotes. *Section 2.1: Power supply overview*: updated bullet points. *Section 3.1: Analog power*: updated bullet point concerning V_{REF+}. *Section 6.4: Decoupling*: updated value of the pool capacitor to 1 µF (instead of 100 µF). *Figure 10*: updated figure content and footnotes. *Section 8: STM8 development tools*: updated bullet point 5 regarding STM8L101-EVAL. *Section 9.1: Integrated development environment*: added the low-cost ST-Link tool in the list of hardware tools supported by STVD.

Table 4. Document revision history (continued)

Date	Revision	Changes
06-Nov-2012	4	Document updated to include the STM8AL products. Added *Table 1: Applicable products*. Added note (1) to *Table 2: Component list*. Updated references in *Section 8: STM8 development tools*.
23-Jul-2013	5	Updated: – *Section 2.1: Power supply overview* – *Section 2.3: Power-on/power-down reset (POR/PDR)*

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